# WILDLIFE REVIEW

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The Transactions of the Third North American Wildlife Conference, a paper-bound volume of x+901 pages, published in November 1938, may be obtained from the American Wildlife Institute, Investment Building, Washington, D. C., for $1.00 a copy, postpaid.

Biological Survey: Canadian big game

Anderson, R. M. The present status and distribution of the big game mammals of Canada, pp. 390-406, 11 maps.

Factors affecting wildlife, including lumbering, farming, trapping, and the introduction of improved firearms. Protection now afforded mammals. Discussion (in 10 cases with maps showing past and present distribution) of the status of the following forms: Buffalo, musk-ox, antelope, elk, eastern woodland caribou, western woodland caribou, mountain caribou, barren ground caribous, mountain goat, bighorns, mule deer, white-tailed deer, moose, black bear, and grizzly bears. Bibliography of 12 titles.

Conservation: Fur animals

Hamilton, W. J., Jr. The conservation of the nation's fur resources, pp. 518-523.

Fur animals are a natural resource of the first rank and returns from trapping are of vital importance to certain low-income groups. Indications are, however, that they are decreasing at an alarming rate. Overtrapping and other factors responsible for the decline are discussed. Conservation demands good management and that in turn depends upon adequate research. Notes on what is being accomplished and suggestions as to what may or should be done in the way of fur animal research. Need for public education on proper trapping practices and for cooperation of the fur industry in practical conservation and in support of research.

Conservation: In Mexico

Zinser, Juan. A message from Mexico, pp. 10-15.

Establishment of 25 national parks as a speedy method of checking inordinate lumbering operations and illegal killing of game. Restrictions on quail exportation permits; no wild turkeys can be exported. Description of two game reserves, one in Chihuahua, the other in Sonora. A study of predatory animals in Guerrero revealed pumas high, and white-tailed deer low, in numbers. No action was taken and in 2 years the ratio was reversed. "There was a remarkable decrease in the number of pumas and on the other hand, deer had multiplied to an extraordinary extent. The hand of man had no part in this change, but only the action of nature." Exploitation of guano deposits and of guano birds has been forbidden by presidential decree. Meanwhile the situation will be studied with a view to formulating appropriate legislation and regulations.

Conservation: Waterfowl

Lloyd, Hoyes, Juan Zinser, and Frederick C. Lincoln. What is the status of waterfowl?, pp. 161-171.

Lloyd. Summary for Canada by Provinces. The situation is not wholly good nor wholly bad. Restrictions on hunting seem to have checked the downward trend. With continued patient cooperation it seems possible that the waterfowl may be brought back to modest abundance. The only danger would appear to be too optimistic a view of the situation.

Zinser. A conservation campaign, both educational and coercive has been required in Mexico. Armada shooting is being done away with. Geese were more numerous than the previous year. The status of wild fowl is briefly noted. Upland plover have been given complete protection.

Lincoln. Report on breeding ground surveys, flyway studies, and the January inventory of waterfowl. An increase in the population of from 10 to 20 percent over that of a year ago is indicated. This does not justify great optimism as the total number of migratory wild fowl probably is not more than half what it was a decade ago.

Control: Cultural methods

Spencer, Donald A. Cultural methods and other practices used in the control of injurious wildlife, pp. 699-704.

Cultural methods are those involving modification of agricultural practices; examples are given. Defensive control is discussed under the heads of scarecrows, repellents, fences, and transfer of offending animals. Aggressive methods are illustrated by the New England field mouse control campaign which is fully described, particularly as to safeguards employed. (Abstract from WILDLIFE REVIEW, No. 15, July, 1938, p. 42.)

Destruction: Migratory wild fowl

Pearson, T. Gilbert. International migratory bird protection on North America, pp. 197-200.

Brief history of efforts at international bird protection in Europe negatived to a considerable extent by Italy's abandoning all restrictions in reprisal for strictures on its Ethiopian campaign. In the western hemisphere there are 10 countries in which there is not the slightest protection for birds. South of Mexico there are no game wardens. In the West Indies shore birds and ducks are slaughtered both by residents and by tourists from the United States. What we go to such lengths to protect on the mainland is there wantonly destroyed. While tinkering with a leaky tap the bunghole has been left wide open.

Diseases and Parasites: Of bighorn sheep

Potts, Merlin K. Observations on diseases of bighorn in Rocky Mountain National Park, pp. 893-897.

The bighorn has been greatly reduced not only in contrast to its numbers when the West was first invaded by white men but also in very recent years for which definite records exist. Scabies, doubtless contracted from domestic sheep, is known to have killed bighorns. This paper reports field observations and autopsies revealing hemorrhagic septicemia and lungworms, followed by infection with Corynebacterium pyogenes, and other bacteria. Weakened resistance due to malnutrition is indicated as the principal predisposing cause of the disease which has caused alarming mortality. To save the bighorn, it is essential that adequate year-round range and isolation from domestic stock be provided and that hunting be stopped.

Diseases and Parasites: Botulism

Coburn, D. R., and E. R. Quortrup. The distribution of botulism toxin in duck sickness areas, pp. 869-876.

Review of early studies to demonstrate the presence of preformed toxin in the field shows that Gunderson in 1931, working at Tule Lake, Oregon, was the first to prove conclusively that such preformed toxin did exist in natural media. Twenty-nine percent of the suspected samples examined in this sickness area showed the presence of botulinus toxin. Demonstration of preformed toxin under natural conditions in the field was made from carcasses of birds which had died of botulism; also in the surrounding shallow water, in the mud underlying such bodies, and in sarcophagid fly larvae feeding on these carcasses.

The possibility of toxin production on other natural bird foods has been demonstrated by the use of these as culture medium in tests with artificial incubation. Gunderson produced potent toxin through the use of grains commonly employed in baiting ducks. Suspicion was cast by Kalmbach and Gunderson on the surface slime and silt rich in organic matter which overlies much of the low marsh lands. Studies by the authors have demonstrated that the suspected ooze can and does act as culture medium for the production of the toxin. In decaying bodies of birds the toxin is produced under favorable conditions in from 3 to 4 days. The time during which it may be lethal depends upon numerous factors, chief of which are dilution by water, dissociation by sunlight, oxidation, neutralization, and fixation by organic acids. Greatest losses of wild fowl ascribed to botulism in the inter-mountain region have come in seasons of drought followed by heavy rainfall in August and September. The greatest bacterial activity takes place during the time required for 2-3 inches of water and the underlying ooze to evaporate to dryness. Drying does not destroy the toxin, but leaching and complete submersion with the attendant dilution renders it harmless. Re-evaporation, however, may concentrate the poison and again make it lethal for birds. Wind also may push water over flats with resulting formation of toxic pools when the water recedes. Descriptions are given of 5 typical, though dissimilar outbreaks of botulism, and suggestions made in each case as to how the difficulty can be eliminated.

Diseases and Parasites: Enlarged spleen in deer

Aiton, John F. Enlarged spleen in whitetail deer at Glacier National Park, pp. 890-892, 1 table.

Weights of deer and their kidneys and spleens tabulated; lesions of spleen described; no diagnosis of cause.

Diseases and parasites: Malignant edema

McKenney, F. D. Malignant edema in deer, pp. 886-889.

From author's abstract: The malignant edema group of organisms is frequently responsible for disease in domestic animals, particularly sheep. One outbreak of this malady in deer has been reported and unpublished records show that the same organism has been identified in autopsied deer in various parts of the country. This report deals with a recent outbreak of disease in deer from which the bacterium causing malignant edema (Clostridium septique) was isolated. Remarks are made on the growth and other characteristics, including its effect when injected into laboratory animals. From a study of the gross and microscopic changes present in deer dying from the disease, it is concluded that the malady can not be diagnosed on the basis of post-mortem findings. It is believed that the difficulty attendant on culturing and identifying the bacillus, which will not grow in the presence of oxygen, may in part be responsible for the failure of other workers to attribute the death of deer occurring under similar circumstances to the malignant edema group of bacteria. Since the organism is ubiquitous and in the past has been associated to some extent with putrefactive processes, there may be a tendency to neglect it as a causative agent in disease. Further data are necessary to determine the extent of occurrence of this malignant edema, percent of mortality in deer resulting from it, and the means by which spontaneous infection becomes disseminated.

Diseases and Parasites: Sarcosporidiosis

Shillinger, J. E., and P. W. Wetmore. Sarcosporidiosis a protozoan disease of wildlife, pp. 898-901.

While numerous abnormalities in wildlife evade popular notice, infestations with Sarcosporidia are often so conspicuous as to attract attention. Cattle, sheep, and a great variety of wildlife are now known to be affected by this protozoan, the cosmopolitan representation of which probably can well be considered a single species, S. miescheriana. The life history and pathology of the organism are little understood. The greatest loss now attributable to it is waste of meat of various kinds rejected because of gross infestations. Bibliography of 7 titles.

Diseases and Parasites: Shock disease in snowshoe hare

Green, R. G., C. L. Larson, and D. W. Mather. The natural occurrence of shock disease in hares, pp. 877-881.

Some of the extensive decimations of snowshoe hares (the "drop" in the cycle) are described. During the most recent die-off, numerous hares were observed dying of the condition later recognized as shock disease. Lesions and symptoms are described.

Authors' abstract: "Spontaneous deaths of snowshoe hares from shock disease have been observed under natural conditions and studied intensively in fenced areas of natural cover. Shock disease develops in young hares during the summer and may produce heavy mortality within five to seven weeks of birth. Shock disease has been shown to involve hare populations to a degree that corresponds to the extent of the mortality which has been observed during the die-off period. It is concluded that deaths fundamentally due to shock disease are responsible for the periodic decimation of snowshoe hare populations." Bibliography of 6 titles.

Diseases and Parasites: Tick fever, deer in relation to

Shillinger, J. E. Deer in relation to fever tick eradication in Florida, pp. 882-885.

Brief notes on the fever, its vector, Boophilus annulatus, the control campaign against which from a territorial point of view is 90 percent completed. In central and southern Florida, however, there is a variety of the tick that lives upon deer as well as upon cattle. It must be controlled to complete the conquest of cattle fever in the United States. Since it is not possible to disinfect the deer as is periodically done with cattle, the elimination of most of the deer in certain districts in Florida appears to be the remedy. The infested areas in the State are relatively small and the total number of deer to be removed represent only a small percentage of the entire deer population. Undesirable as this process may appear to some people, it will affect comparatively few hunters. If it has the ultimate result of reducing the degree of tick infestation on the remaining and future deer population in Florida, the process will be worth while from that point of view alone.

Precedent for wholesale destruction of deer exists in the elimination of deer in certain areas in California in 1924, during the outbreak of foot-and-mouth disease in that State. After a very few years the area in which the deer were slaughtered became abundantly restocked by immigration of animals and by rapid reproduction. Undoubtedly eradication in Florida would be followed by similar prompt recovery of the deer population.

Ecology: Appraisal of quail habitat

Massey, A. B. A yardstick for measuring the habitat of the bobwhite quail, pp. 782-786, 7 graphs.

Segregation of the data on food in Stoddard's "The Bobwhite Quail," etc., (1932) by classes and presentation of graphs to show their seasonal utilization. Discussion of possible values in connection with physiological requirements of the birds. A bobwhite range lacking in any of the principal classes of nutriments is not suitable habitat. Appraisal of quail environment should determine whether there are available native plants of types that will satisfy the dietary needs of the species.

Ecology: Census methods, pheasant

Bennett, Logan J., and George O. Hendrickson. Censusing the ring-neck pheasant in Iowa, pp. 719-723.

Authors' abstract: In the winter of 1935-1936 Iowa suffered the most severe weather ever recorded. During the fall shooting season of 1935 about 50 percent of the ring-necked pheasants were taken and the severe weather exacted a further toll of about 25 percent. The following summer the Conservation Commission realized that a very close check should be made to determine if Iowa had enough pheasants to justify an open season. Recalling observations made during years of abundance, it seemed that the number of birds seen along secondary gravel roads in the early morning and late evening to some degree indicated the population. The writers, therefore, developed a plan under which conservation officers drove in automobiles at least 20 miles on gravel roads in three parts of a county on three successive days between the hours of 6:00 and 8:00 A.M. The total number of birds observed divided by the total miles gave the average number of birds recorded per mile. It was found that 8-10 birds per mile indicated a population of one bird to four or five acres; 2 birds a population of 1 to 7-9 acres; and one, a population of 1 to 18 acres. Surveys were made by the method indicated and in most cases by the same men in a given territory in both 1936 and 1937. The comparative figures of the two years gave the relative increase or decrease of the pheasant population in each county. In 1937 the figures showed a decided decrease in the population under that of 1936 and enabled the Conservation Commission to close the season with a minimum of criticism. Previous to 1936 the Commission used a mass driving method to census pheasants at a much greater cost and with unsatisfactory results. The present method is performed during regular patrol hours by conservation officers at no extra cost to the Commission.

Ecology: Drainage operations

Cottam, Clarence, W. S. Bourn, F. C. Bishopp, L. L. Williams, Jr., and William Vogt. What's wrong with mosquito control?, pp. 81-98.

Cottam and Bourn. Mosquitos may legitimately be controlled but methods that are needlessly detrimental to wildlife should not be used. A large percentage of mosquito-control projects hitherto conducted in this country, however, have been unnecessarily destructive either to wildlife or to its habitat. Figures are given on the extent of ditching in both fresh-water and brackish environments. Salt-marsh ecology is described both before and after drainage and the reduction in invertebrates in the various vegetative types (43-92 percent) emphasized. The destruction of these animals and of wigeon-grass in drained ponds has greatly reduced food supplies for wildlife. Use of non-volatile oil, also extensive, is destructive and should be abandoned in favor of the harmless as well as more economical pyrethrum larvicides. Biological methods of control are most acceptable to conservationists and their possibilities for development have not been exhausted. It has been demonstrated that necessary mosquito control can be correlated with wildlife conservation.

Bishopp. Mosquito control might be criticized because it was not started soon enough nor done with sufficient thoroughness. Recent operations with emergency labor, while subject to criticism, are not a fair sample of anti-mosquito work. Not all wildlife proponents condemn mosquito-control operations; supporting letters from two in the eastern salt-marsh region are quoted. Notes on human and animal diseases transmitted by mosquitoes and their importance. Benefits of mosquito-control in farming, recreational, and residential areas. Mosquito control workers want to see wildlife conserved and while exercising necessary control of these pests will do it with the least possible disturbance to wildlife. Research directed toward improvement in methods is needed.

Williams. In answering the question, "What's wrong with mosquito control?", this speaker would reply that there isn't enough of it. He admits the possibility of some mistakes in the ditching to control malaria mosquitoes but thinks that the number is so small as to be negligible. Drainage during settlement of the Upper Mississippi Valley is what made that area habitable by a healthy population. Today the movement has been reversed and water is being impounded; malaria is returning and will increase. Malaria costs the people of the South about half a billion dollars a year. "I doubt if the small amount of damage that antimalaria drainage does to wildlife is even a fraction of what it is costing the people of this country to keep malaria." Those impounding waters should at the same time adopt measures to control the breeding of mosquitoes.

Vogt. Mosquito control that is intelligently conceived, expertly prosecuted, adequately maintained, and completely justified is non-existent. Ditching has been so extensive that communities do not appropriate the funds necessary for maintenance of the ditches, and an uncared for ditching system may intensify rather than abate the mosquito nuisance. Mosquito control is not as effective as claimed and does not justify the great expenditures that have been made. Malaria has increased in the Southeast at the same time that an intensive ditching campaign was under way.

[Comment. Discussion participated in by the speakers cited and others is reported on pp. 98-107 but is not abstracted. To an innocent bystander, it seems that these panel discussions "generate more heat than light" and verify the adage that "a man convinced against his will is of the same opinion still."]

Ecology: Drouth versus wildlife

Wade, Douglas E. Drouth intensity measurements and the effects of the 1936 drouth on wildlife, pp. 558-569, 2 figs., 6 tables.

Author's abstract: "The first five and one-half months of the growing season of 1936 were characterized by record-breaking temperatures and lack of moisture. The Munger drouth intensity index used on Madison, Wisconsin, weather data, provided a workable method in comparing one growing season with another and in correlating the effects of the season's drouth on animal populations, movements, food habits, and physiology.

"A brief review of other writers shows the scope of work already done on the effects of drouth on wildlife. Tomatoes grown in 1936 were deficient in vitamin C. This may offer a clue to the effects of drouth upon wildlife food. Further work in this field is suggested.

"Population statistics showed a state-wide decline of all game during the drouth season except pheasants. A theory is advanced that pheasants are an exception because of readiness to leave spoiled eggs in time to nest again. Game bird eggs in cooked condition were found during July. Quail in one area failed to reproduce heavily, and the young birds seen had been hatched late in the season. Quail in one instance erected a grass roof over the nest during a period of severe heat. Quail and rabbits performed unusual movements during July.

"Mice exhibited extraordinary food habits by girdling red-osier dogwood and yellow willow during July. Squirrels and sapsuckers fed on sap flowing from cracks in bark of silver maple trees injured by drouth. Drouth-killed trees attracted woodpeckers.

"Record soil surface temperatures during 1936 cooked the cambium layer of plantings, in some cases completely girdling the smaller trees. Larger trees escaped girdling but were defoliated on southern exposures. Plantings made in the open in 1936 suffered 90 percent killing as compared to 10 percent in 1937. Shrubs, vines, and trees planted in 1936 are tabulated according to their drouth-resisting ability.

"Certain wild fruits were found to produce heavily while others dried up or produced poorly.

"Drouth increases marsh hayfield burning and cattle breaching and thus results in loss of valuable coverts and destruction of nests. Drouth years are short-crop years and cut down the available amount of winter feed for wildlife."

Marshes and ungrazed woodlots are high-quality coverts that survive periods of drought and to preserve and increase them tends to insure wildlife against the effects of future drouths. Bibliography of 26 titles.

Ecology: Duck nesting cover

Bennett, Logan J. Redheads and ruddy ducks nesting in Iowa, pp. 647-650, 4 tables.

Author's abstract: "Although records do not exist, it is probable that the ducks named were common, if not abundant, breeders in Iowa prior to the time of intensive agriculture. Twenty-two redhead nests and 22 ruddy duck nests were studied in northwest Iowa from 1933 to 1937 in connection with other waterfowl research. Fifty-nine percent of the redhead nests and 63 percent of the ruddy duck nests were found among growths of Scirpus occidentalis, a bulrush that composed 30 percent of the available nesting cover. The proportions of other cover types and the number of nests of these ducks found in each are recorded in tables. 40.5 percent of all redhead eggs and 76.9 percent of all ruddy duck eggs deposited in nests produced young. The nesting season of the redhead was from May 17 to July 10. The nesting season of the ruddy duck ex-

tended from May 25 to July 25. Dense clumps of cover made accessible by open waterways appeared to be desired for nesting sites by both species. Muskrats made accessible large stands of bulrush cover for nest sites by cutting channels and other openings. There are notes on nesting losses and a table showing the number of nests that failed or hatched week by week.

Ecology: Duck nesting cover

Williams, Cecil S., and William H. Marshall. Evaluation of nesting cover for waterfowl on Bear River Refuge, pp. 640-646, 1 table.

Index values of cover plants to waterfowl obtained by dividing the percent of nests in a cover type by the percent of acreage of that type in the tract studied. These values are discussed and tabulated for 10 kinds of cover, of which hardstem bulrush (Scirpus acutus), while the least extensive, was the most valuable. The order of importance of the various cover types to 7 species of ducks also is stated.

Ecology: Forest wildlife

Horn, E. E. Some wildlife-forest relationships, pp. 376-380.

Forests are communities of interrelated living organisms in which it is impossible for any to function without affecting others. Life is sparse in dense, more abundant in open, forests. Fire and cutting are followed by great changes in the composition of the biota. Ground vegetation soon becomes established and improves the habitat for rodents, and later browse species similarly improve conditions for deer. Mice and chipmunks especially show a liking for coniferous seeds. In California they seem to prefer these in the following order: Sugar pine, Jeffrey pine, ponderosa pine, white fir, and incense cedar. This in the order of seed size but the same choice prevailed when the seeds were ground to a pulp. Few sugar pine seeds escape the rodents and reproduction of this species must depend upon a combination of favorable circumstances (heavy seed production, low consumption by animals, and favorable climatic conditions) which evidently occur only at widely separated periods. There seems a good possibility that parts of the sugar pine-fir-incense cedar associations may give way to fir-cedar because of seed-eating rodent activity. This will make a more closed type of forest and the change may have far-reaching effects upon the deer population. "A thousand acre experimental burn on the Lassen National Forest had the following effect upon wildlife: (1) Deer left the area before the fire and returned in increasing numbers the first year, attracted no doubt by new sprouting shrubs, and increased annual vegetation. (2) Rabbits, chiefly cottontails, were completely killed out, or the few survivors moved off immediately after the fire. Many carcasses were found. (3) Chipmunks were markedly reduced but not eliminated. A breeding nucleus survived at some of the rocky outcroppings. (4) Mice of the genus Peromyscus survived the hottest fire, and were caught in traps in the center of the burned area two days after the fire. Litters of these mice were caught, thus proving that the presence of mice was the result of survival rather than migration onto the burn from adjacent areas." Seed consumption by rodents greatly reduces the number of seedlings that might come up on these

brushfields after a burn. Burns discourage rabbits for several years, possibly due to scarcity of protective cover. Planting a burned area the first season following a fire is, therefore, a good way to avoid rabbit damage. Increase of rodents on recently burned areas attracts predators so that there may be a change in the predator-prey ratio that will affect valuable species. Many lessons for forest wildlife management may be drawn from these animal interrelationships.

Ecology: Reclamation in relation to wildlife

Page, John C., S. B. Locke, S. H. McCrory, and G. W. Grebe. What is or should be the status of wildlife as a factor in drainage and reclamation planning?, pp. 109-124.

Page. Speaking for the Bureau of Reclamation, the Commissioner reports cooperating with the Biological Survey and setting aside 28 reservoirs as waterfowl and wild life refuges; also that farmers on the Federal irrigation projects are deeply interested in wildlife conservation.

Locke. Magnitude of drainage, much of it unjustifiable. Value of the areas in their original conditions for wildlife production and other purposes. There is no overproduction of wildlife crops, and 17 million acres are needed for waterfowl refuges. There should, therefore, be no additional drainage except where value of the operation, including general public values, is demonstrated. Reclamation reservoirs are not of high utility to wildlife. Land-use policies should be sound and there should be some brake upon action so that projects will not be adopted until they have been approved by a competent agency.

McCrory. When a new drainage enterprise is proposed, there should be careful consideration of the advantages the area offers for different uses, including wildlife production and recreation. "Without proper drainage on his farm a farmer can not be successful" and his needs should be sympathetically considered by conservationists. The Upper Mississippi Wildlife and Fish Refuge as an example of careful planning and of cooperation between all interests concerned. Similar policies have guided consideration of farm drainage proposed as CCC projects. Nearly all classes of people are interested in wildlife but some of them could well do a little more effective thinking about it.

Grebe. "Irrigation as a whole, as distinguished from drainage, has created more wildlife environment than it has destroyed." Ignoring the original biota, habitat for wildlife is improved by irrigation, including food and cover in addition to the water supply. Auxiliary reservoirs make excellent retreats for wild fowl. Irrigation developments in the Boise Valley, Idaho, have increased wild fowl a hundred-fold in 30 years. Discussion of defects in irrigation practice in relation to wildlife, chiefly to fishes. "Reclamation of lands by drainage of swamps or natural lakes, on the other hand, is destructive of all forms of wildlife and should never be undertaken unless and until it can be shown that flooding of other lands will provide an equally successful wildlife environment. The status of wildlife as a factor in drainage and reclamation planning should be such that wildlife be given full consideration before

any project is approved. The millions of people who are interested in conserving and restoring the wildlife of the American continent should be properly represented, and all facts, figures, and values adequately weighed and balanced."

Ecology: Ruffed grouse cover requirements

Bump, Gardiner. Analysis of certain cover requirements of the ruffed grouse in New York State, pp. 818-824, 3 figs., 3 tables.

The characteristics of the ruffed grouse likely to govern its utilization of cover apparently adapt the species to a wide range of environmental conditions. For 8 years these conditions have been studied on 4 widely separated but representative areas in New York. Cover requirements vary seasonally and cover classes available to the birds may be conveniently grouped as open land, overgrown land, woodland, and slashing. These are further subdivided into 12 types. Interpretation of cover utilization based on more than 13 thousand flushing records reveal that the most important characteristic of winter grouse cover is the presence of a substantial proportion of conifers; conifers are abandoned for hardwoods as spring advances, and are little used in summer when overgrown lands with abundant herbaceous growth are favored; "edge" types furnishing food and coniferous growths affording shelter increase in importance as fall progresses. Some 1,200 nesting records indicate a preference for sites in second growth hardwoods; and 1,500 brood records show that predominant use is made of overgrown land or woodland herbaceous cover. The findings are tabulated.

Education

Gootenberg, Phil, Ernest G. Albright, C. R. Gutermuth, and John C. Caldwell. Public apathy a problem of wildlife restoration, pp. 31-41.

For the relief of the problem posed in the title, all of the authors advise education, particularly of the youth. Gootenberg would do this through the press, Albright through a junior game warden patrol, Gutermuth through conservation clubs, and Caldwell through the schools. Methods and results are cited in greater or less degree by each.

Education: Wildlife management

King, Ralph T. What constitutes training in wildlife management?, pp. 548-557, 1 fig.

Author's abstract: "Training in wildlife management must include much of animal biology, environmental constituents and relations, and land utilization. These older fields of knowledge provide three of the four cornerstones that constitute the foundational basis of wildlife management training, viz., zoology, ecology, and economics. The fourth cornerstone is wildlife management techniques, a new field of knowledge and one that is peculiarly the prerogative and responsibility of the wildlife technician.

"Several of the special divisions of zoology, botany, forestry, agriculture, economics, and sociology are distinctly a part of wildlife management and contribute directly to training in this field. These divisions are listed and their contributions evaluated. Those phases of wildlife management not included in previously existing courses are considered and the necessity for and advisability of incorporating new courses in the curriculum is discussed.

"The importance of a background such as can be provided only by biological, ecological, economic, and historical knowledge is stressed and the complete dependence of wildlife management on the ecological approach and the economic point-of-view is reemphasized."

Bibliography of 9 titles.

Food Habits: Cottontail

Trippensee, R. E. Food relationships of the cottontail rabbit in southern Michigan, pp. 794-804, 4 tables.

Report upon a combined observational and experimental study of the foods and alimentary physiology of the cottontail. An extensive list is presented of trees, shrubs, and herbs eaten by this rabbit in Michigan, and a shorter one quoted for Connecticut. Three tables are devoted to experimentally determined preferences among leafy foods, barks, and coniferous transplants.

Author's summary: "(1) Cottontail rabbits show a seasonal rhythm in fat storage which appears to be related to physiological and weather relationship; (2) digestion of cellulose is probably by enzymes; (3) average daily solid food consumed is 55.23 grams and 92.09 grams of water for a 1,238.89 gram rabbit; (4) fecal elimination of rabbits takes place largely during the feeding period. Thus the presence of rabbit feces shows areas of feeding rather than specific territories of individual animals. As many as 352 individual pellets may be eliminated by one rabbit in a 24-hour period; (5) minerals are needed by rabbits and are obtained in roads or other places where soil is exposed; (6) rabbits use a wide range of plants in their yearly diet. They are selective and prefer some foods over others. Dandelion, alfalfa, and red clover are the choice summer foods and the bark of apple is high in the dietary choice whenever available as a winter food. The bark of black cherry, staghorn, sumac, and black raspberry canes also rate high; (7) the first choice of conifers seems to rest with the exotic species including the needles, stems, and buds of Corsican pine and Scotch pine." Bibliography of 8 titles.

Food Habits: Deer and elk

De Nio, R. M. Elk and deer foods and feeding habits, pp. 421-427, 2 tables.

Author's abstract: "Winter food supply is the controlling factor on the big game ranges of Montana and northern Idaho. Therefore, game population is directly proportional to the quantity and quality of the food supply available during the critical winter periods. Because of the controlling factor all big game studies have been limited to the winter ranges.

"To secure information that will eventually be incorporated into management plans the Forest Service of Region One has conducted game studies on winter ranges for twenty or more years. Beginning in the winter of 1933 all studies have been conducted systematically using standardized instructions, forms, and equipment. They have included projects on all of the winter game ranges of 17 National Forests. These Forests represent a gross area of 26,759,309 acres and a population of 109,037 deer and 37,545 elk (1937 census).

"Foods and feeding habits have assumed a high priority in the studies of deer and elk, with the determination of carrying capacities as the main objective. In making this determination, data have been collected on the species and volume utilized and non-utilized by deer and elk and the influence of snow depths and temperature upon this use and availability, also on the preference and nutritive values of the forage species utilized.

"Data collected by direct observations in band trailing, clipping and study plots, and stomach content analyses show a total of 225 different forage species utilized. 447 deer and elk stomach content samples have been collected in the Region over a period of four years, representing every big game area. Of these, 59 deer and 53 elk stomach content samples have been analyzed in detail. An analysis of the 53 elk records show that normally December is the month during which the consumption of grasses by elk decreases and that of shrubs and conifers increases. In April, utilization of shrubs and conifers decreases sharply and grasses increases correspondingly. In comparing the results of the analysis of food consumption of 53 elk and 59 deer based on quantity by weight, the deer consumption of shrubs in their winter diet is 52.53 percent while elk consumption is only 15.46 percent. On the same basis conifers for deer are 35.61 percent as to 11.75 for elk, grasses for deer 3.04 percent against 56.58 for elk."

A table lists forage species and gives data on their availability, utilization, and palatability. General observations relate to the effect of weather on movements and feeding habits of the animals, on critical winter periods, and on utilization and nutritive value of coniferous browse.

Food Habits: Elk

Baldwin, W. P., and C. P. Patton. A preliminary study of the food habits of elk in Virginia, pp. 747-755, 2 tables.

Authors' abstract: "The elk (Cervus canadensis) was exterminated in Virginia more than a hundred years ago. Recent liberations of western elk have resulted in established herds in Giles-Bland counties and Botetourt county. Field observations on their food were made in March, August, September, October, and November of 1937. In March, feeding was principally on the twigs of black locust, scarlet oak, wild cherry, and sassafras and the evergreen plants of wintergreen and galax. Summer and fall observations revealed New Jersey tea to be the major food, with galax and wintergreen being taken to some degree. Samples from eight stomachs collected in November of 1936 and 1937 were analyzed at the Section of Food Habits, U. S. Biological Survey. Over 100 different items were identified; the most important of these were grasses (26%), New Jersey tea (11.87%), galax (11.87%), wintergreen (9.12%), miscellaneous leaf fragments and vegetable tissue (6.12%), miscellaneous twigs and woody tissue

(4.00%), oaks (chiefly acorns) (3.63%), blueberry (2.25%), gill fungus (1.00%), and others. Approximately 50% of the total food in these November stomachs was eaten in green condition. [The food items are tabulated in detail.] A summary of the field observations and stomach examinations shows that the principal diet of elk in Virginia consists of grasses, available cultivated crops, galax, and wintergreen throughout the year, New Jersey tea during the growing season, and acorns, and twigs of deciduous trees in fall and winter."

Food Habits: Mourning dove

Knappen, Phoebe. Preliminary report on some of the important foods of the mourning dove in the southeastern United States, pp. 776-781, 3 tables.

Report on analyses of 219 stomachs from the region cited and comparison in a table of percentage ranking of leading food items of that section and of the United States (based on a thousand examinations). The diet in the Southeast is discussed by one- and two-month periods and by plant groups. The 10 groups of most importance in producing food for mourning doves in the South are grasses, legumes, composites, spurges, pines, pokeweed, cranesbill, sedges, chickweed, and smartweeds.

Food Habits: Utilization of woody plants

Van Dersal, William R. Utilization of woody plants as food by wildlife, pp. 768-775, 2 tables.

Food the greatest necessity for wildlife and adequate knowledge of it of corresponding importance to management. Comment on published information on food habits and tabulation of comparative plant utilization of 147 species based on search of the literature and of the stomach analysis records of the Biological Survey. The red cedar (Juniperus virginiana) stands at the head of the list and records of its utilization are separately tabulated. Discussion of points of interest brought to light by the compilation and emphasis on the need for much additional information. Bibliography of 30 titles.

Food Habits: White-tailed deer

Aldous, Shaler E., and Clarence F. Smith. Food habits of Minnesota deer as determined by stomach analysis, pp. 756-767, 4 figs., 2 tables.

Despite the title, this is a combined report on field and laboratory studies pertaining to deer of northeastern Minnesota.

From authors' abstract and conclusions: The stomachs examined were of 22 of the animals killed during the fall hunting season and of 52 victims of winter vicissitudes. The number of plants identified in the fall stomachs was 45 and in those of the winter, 25. Evergreens including balsam fir, pine, white cedar, and spruce formed a little over one-fourth of fall food but increased to almost three-fourths of the late winter feed. White cedar, the most valuable of the deer browse species, increased only 3%, the greatest bulk of the winter subsistence being derived from balsam and pine. Willows and poplars

formed 29% of the fall diet but decreased to less than 4% in the late winter. Species within the heath, honeysuckle, and birch families formed minor parts of the diet during both periods. A graph showing the availability of the different kinds of browse in the Superior National Forest and the results of browse utilization studies is presented. Three figures show diagrammatically percentages of frequency and volume occurrence of the foods eaten. The tables give: (1) A list of all foods identified, the number of their occurrences, and names of the parts eaten; and (2) a summary of availability of browse species and the degree of their use by deer in the Jonvick deer yard.

The conclusions drawn were: (1) The stomach analyses, together with available browse surveys indicate that the winter carrying capacity for deer in northeastern Minnesota is on the decline; (2) the browse species forming the greater part of the winter food are those most available but not of the greatest nutritional value; (3) many of the choice browse species are either uncommon or are becoming unavailable due to heavy browsing; (4) balsam fir may be a good deer browse when eaten in moderate amounts in combination with more nutritious foods, but when eaten alone or in too great a proportion to other foods is not capable of maintaining good health; (5) maple brush is the most available of the choice browse species in this area. Other kinds may be locally abundant but are more spotted in their distribution; and (6) the variation in availability of browse species in the different concentration areas indicates that conclusions and management practices will have to be developed and applied to quite limited districts.

Life Histories: Cottontail

Dalke, Paul D., and Palmer R. Sime. Home and seasonal ranges of the eastern cottontail in Connecticut, pp. 659-669, 4 figs., 9 tables.

Authors' abstract: "An intensive trapping experiment was carried on for a period of 15 months on a 471-acre sanctuary near Rockville. A total of 68 traps were used and located in 13 different cover types. These cover types are described, indicated on a map, and their areas and percentages of the whole tabulated.

"The greatest concentration of rabbits on the sanctuary occurred in the area of most interspersion of cover types including cultivated fields. The 0-10 year age classes of timber types, shrubs and sedge swamps are the most important permanent cover types. Identification of rabbits was accomplished by use of ear tags and colored celluloid washers. In this manner sexes could be distinguished in field. The trapping technique is described. Trapping success varied greatly and not entirely due to the number of traps in the field. Cloudy and partly cloudy days gave better results than clear or rainy days. Greatest trapping success occurred in November, March, and June. Restriction of cover in October and November tends to concentrate the rabbits in a smaller area. In March the breeding season begins with greater movement, especially on the part of males. In June the immature animals are beginning to move and were largely trapped. Although the number of traps in the field varied from 14 to 68, the average daily catch for any month never exceeded 3 rabbits. Males were retrapped from 3 to 16 times over periods varying from 66 to 435 days, and females from 3 to 40 times over periods of 59 to 388 days. There appears to be

no definite correlation between the number of times an animal is retrapped and the period over which the trapping occurred. For example, one animal was retrapped 5 times in 387 days and another 40 times in 344 days, while a third was retrapped 16 times in 69 days. Tables and charts give the details of retrapping success.

"The area occupied by females varied from 0.6 acre to 8.4 acres with an average of 3.0 acres. Male rabbits ranged over territories of from 0.5 acre to 21.6 acres with an average of 8.3 acres. Composite maps of ranges of males and females indicate that male territories may overlap 50-80 percent. Each male territory touched upon those of 4 to 6 females. There appears to be no habitual separation of either male or female territories. Less definite results, in these respects, were obtained for the young. Dispersal, however, does occur. Four rabbits were recovered 1.0, 1.1, 1.4, and 2.4 miles from points of tagging. They were not forced to seek new territory because of fire or flood and were not subjected to undue predation."

Life Histories: Cottontail

Hendrickson, George O. Winter food and cover of Mearns cottontail, pp. 787-793, 2 tables.

Iowa farms that may have sufficient winter food for cottontails are characteristically lacking in cover. Simple observation and pellet counts yielded more information than trapping. Rabbits found better cover in orchards than in bluegrass pastures and alfalfa fields. Individual cottontails were observed each to use a single form regularly and several other forms intermittently for short periods. Weedy growth, particularly foxtail (Setaria spp.), was used more for winter shelter than nearby evergreens, shrubs, brush piles, and cordwood stacks. Apple prunings were available and bark of apple (Pyrus malus) was fed upon in preference to that of 8 other species of woody growth in one locality, and sumac (Rhus glabra) used in preference to 11 other species of woody growth in a second locality. The utilization of several types each of cover and food is discussed. The author concludes that strips of grass along fence rows would enable the rabbit population to occupy larger areas.

Life Histories: Coyote reproductive cycle

Hamlett, G. W. D. Reproductive cycle of the coyote, pp. 524-526.

Report on a histological study of testes and ovaries collected at all seasons combined with a summary of field notes on breeding and on numbers of young in dens. The coyote has a definitely limited breeding season that is somewhat longer, however, in males than in females. Production of more than one litter in a year is highly exceptional. The period of gestation is 60-63 days, the average number of embryos in pregnant females 6.23, and of young in dens 5.7. (Abstract quoted from WILDLIFE REVIEW, No. 15, July 1938, p. 22.)

Life Histories: Duck nesting

Kalmbach, E. R. A comparative study of nesting waterfowl on the Lower Souris Refuge: 1936-1937, pp. 610-623, 1 fig., 5 tables.

Summary of results of a study of crow-waterfowl relationships in Canada that has already been abstracted in WILDLIFE REVIEW (No. 10, October 1937, pp. 9-10; No. 12, February 1938, p. 7). Similar work was continued on the Lower Souris Migratory Waterfowl Refuge in North Dakota through the two seasons reported upon. The technique of the nesting studies is described and the risk of predators being attracted to nests visited by man discussed. Destruction of nests by crows was much less than revealed in the Canadian studies, 1.7 percent for the first year and 3.4 percent for the second. On the Souris, skunks caused the loss of 30.4 percent of the nests in 1936. The next year after a control campaign, and also after there had been a great shift in the duck nesting area, the damage was reduced to 6.5 percent. Other causes of nesting losses also are discussed. Nesting densities are estimated and compared with those of the Bear River Refuge in Utah. The relative abundance and percentage of hatch of the 6 more common ducks is tabulated. Late nestings are more effective than early ones; details are presented in a table. Degree of concealment sought for nests appears to be a specific trait as the ranking of the species in this respect was the same in both seasons. In general, however, the results of the studies have so varied from year to year that a long-time investigation is clearly indicated as necessary to reliable findings.

Life Histories: Fox squirrel

Baumgartner, Luther L. Population studies of the fox squirrel in Ohio, pp. 685-689, 5 tables.

Author's abstract: "Population studies are being conducted at six stations representing as many habitat types. These include 13 woodlots with a total population of about 525 squirrels of which 389 have been trapped and tagged. Based on retakes, 141 squirrels tagged from September to December 1936 (with 24.81% repeating), the average squirrel moved 149 yards. Tagging to date indicates a normal maximum range of 375 yards from the point at which first trapped. Unpastured woodlots were found to have higher squirrel populations than pastured woods. Winter-fed woodlots contain higher concentrations than either pastured or unpastured woodlands where no extra food was supplied. Five different census methods were employed: Spot count, leaf nest count, exhaustive trapping, and two by mathematical computations.

"The sex ratio for the 362 squirrels handled from September 1, 1936, to January 1, 1938, was 48.89% male, with extremes of 83.33% in August to 38.89% in October. During the 1937 hunting season, 954 squirrels examined, which had been shot by hunters, were 55.5% males. Differential activity between the sexes explains apparent sex ratios at variance with the actual ratios.

"Twenty-five used dens were examined and detailed measurements taken. There appear to be two types of dens, a small shelter den and a larger den in which the young are born. The dens are used over again for years. The leaf-nest study covered 134 winter leaf nests and 101 summer leaf nests, a total of 235; their locations are described and classed by percentage of occurrence by sites.

"A survey of the fox squirrel harvest during the 1937 open season revealed that the average fox squirrel hunter hunted an average of 3.42 days and

killed an average of 3.47 squirrels. Average weights and measurements of 181 specimens are tabulated.

"Fox squirrels have been observed to eat 36 different kinds of food at various seasons of the year. The ten leading foods, in the order named, were: Hickory nuts, acorns, beechnuts, corn, black walnuts, buckeyes, maple seeds and buds, elm seeds and buds, hazelnuts, and blackberries."

Life Histories: Gray squirrel

Chapman, Floyd B. Summary of the Ohio gray squirrel investigation, pp. 677-684, 5 tables.

Carried out on State forests and game preserves, the ecology of which is briefly described, the study included an appraisal of land-use trends as they influence the gray squirrel, a survey of methods of harvesting the crop, examination of specimens in connection with a controlled shooting program, and certain phases of the life history of the species. Weights tabulated by years, and by sex and age classes; they varied remarkably. The sex ratio of animals bagged by hunters (tabulated) also varied greatly from year to year. Utilization of cavities in trees and leaf nests (of both temporary and of re-used types) is discussed. There are notes also on courtship and mating and parasites and diseases. A cycle of about 5 years probably occurs in the gray squirrel population of the middle west. The results of controlled hunting for three years are tabulated and discussed. Management suggestions are made under 16 headings. Bibliography of 12 titles.

Life Histories: Mourning dove, as a basis for open season

Pearson, Allen M., and Walter Rosene, Jr. Observations on the breeding season of the mourning dove in the South, pp. 865-868, 3 figs.

Report on a study of nesting, gonad development, and growth rate of young, in relation to setting dates for the open season. Authors' summary: "From the information obtained in this study it appears impossible in the southern States to establish an open season on the mourning dove that would neither interfere with the early breeding nor permit the taking of some 'undersized' young birds. An open season from November 20 to January 31 would interfere less with early breeding and at the same time insure the taking of birds of desirable size than would any other period of similar duration. A more nearly ideal season, of shorter duration, would be December 15 to January 15."

Life Histories: Ruffed grouse productivity

Edminster, Frank C. Productivity of the ruffed grouse in New York, pp. 825-833, 2 figs., 6 tables.

The theoretically potential productivity of a species is never even remotely approached actually due to the interference of numerous limiting and decimating factors. The relation of actual productivity to the brood stock

determines whether the population is increasing, decreasing, or static. In a stable population, annual increment equals the losses. The wildlife manager strives to so manipulate environment as to produce this result with population at carrying capacity and the greatest possible proportion of losses occurring from hunting rather than other agencies. The ruffed grouse being cyclic, however, does not have stable productivity. The variations in its rate of increase due to changing effects of the decimating agencies are, therefore, of special interest. Results are reported for an investigation carried on for 8 years on an area near Ithaca, N. Y. Sex ratio, breeding, number of eggs, fertility and viability of eggs, and nest survival were remarkably constant during the upgrade and peak phases of the cycle. Brood and adult survival showed great variation year by year and often considerable variation in single years among different coverts. The trend was of increasing populations for the first three years and was followed by a steady peak population except in 1935 when there were excessive brood losses. Productivity rates were fairly constant throughout except for the year 1935 but indicate a gradual lowering as populations approach either carrying capacity or saturation point. Comparison of productivity on an Adirondack area of connected coverts with that on the disconnected coverts near Ithaca shows that on wilderness range in New York it follows the same trend as on the broken covert range but is consistently lower. The life cycle of the grouse is symbolized and diagrammed.

Carrying capacity depends not only on qualifications of the range but also on those of the species. The chief factor in the latter respect is degree of tolerance of other individuals which determines what is saturation of environment for the species. In marginal to fair grouse range, environmental carrying capacity determines the limit of population density, hence productivity. In good grouse range, the saturation point of the species is reached before the potential carrying capacity can exert its influence and this species characteristic then becomes the ultimate modifying influence on productivity and determines the actual carrying capacity. Saturation point--hence maximum actual carrying capacity--is one bird per four acres of covert in New York. Average actual carrying capacities of most good disconnected range in New York is about ten acres per bird; for Adirondack wilderness range it is about a bird per 20 acres.

Life Histories: Sage grouse

Rasmussen, D. I., and Lynn A. Griner. Life history and management studies of the sage grouse in Utah, with special reference to nesting and feeding habits, pp. 852-864, 3 figs., 4 tables.

Report of progress on work undertaken by the Utah Cooperative Wildlife Research Unit. The original range of the sage grouse was limited to the arid plains of the intermountain and northwestern States and the southern border of the three southwestern Canadian Provinces, agreeing in its distribution with the sagebrush, Artemisia tridentata. Under pioneer conditions it was found in fourteen States and considered the leading game bird in nine of these. Although a number of states have had closed seasons for several years, during the past year, several other western States for the first time closed or greatly shortened the season on this grouse, which has in the past been their

leading game bird. The situation is serious and accurate fundamental information concerning the factors influencing numbers of the sage grouse is necessary if the species is to survive or remain an important game bird.

There is a detailed report on the food identified from 61 stomachs. Adults are highly vegetarian with sage brush and other composites contributing more than four-fifths of the diet. The young are more insectivorous but in a few months change to the adult regimen. The sage grouse does not compete with livestock but these animals spoil environment, particularly winter range, for the grouse. Seasonal activities are described, those of the nesting period in most detail. Observations on 161 nests are presented, particularly on their location in relation to cover types. The highest nesting density observed was 23 nests on 160 acres or 1 nest to 6.95 acres. Clutch and brood numbers and causes of nest failures are tabulated and discussed.

Life Histories: Wood duck

Gigstead, Gill. Wood ducks in the Illinois River bottoms, pp. 603-609.

From the author's abstract: In the lower Illinois River bottoms, wood ducks breed possibly more abundantly than anywhere. During two years observations were made on the birds from the time the first appeared in the spring until they departed in fall. In addition, 27 occupied nests were kept under close observation in the season of 1937 and data were secured on 31 other nests that had previously been occupied by wood ducks. The woodlands near the river provided nesting sites for many birds; 65% of the nests were in oak trees, while others were found in several other kinds. There appeared to be no set preference as to the kind of cavity the ducks would nest in, and great variation was found. Some nests were within 7 feet of the ground and others 35 feet up. The birds seemed to prefer to have the nest about two feet below the entrance. Some entrances were hardly 4 inches in diameter while others were as wide as 16 inches. Incubation was studied by taking a single egg from each of a number of nests and placing them under domestic hens. At the time of pipping the nests were watched until the birds emerged. Six broods were seen coming out of the nests and in each instance the young jumped from the entrance after being coaxed by the mother duck; no other method of emergence was observed.

Predation was most severe during the first week after hatching. Bull snakes did the most damage; a 57-inch snake of this species taken from one nest contained two young ducks and two eggs about to hatch. Other predators included the raccoon, mink, opossum, turtles, and fishes.

Wood duck management was practiced at the Chautauqua Migratory Waterfowl Refuge, 400 wood duck nests were constructed with CCC labor and placed in selected trees. 23 acres of food patch materials were planted along the levee of the refuge. The ducks showed a preference for Wheatland milo maize. Young wood ducks fed in ponds and ditches, sometimes where the only food available to them was insect life, especially larvae of May flies and caddisflies. Usually, however, there was considerable duckweed along these banks and the young birds manifested a great liking for these plants.

In the early fall the birds concentrate in definite locations; as many as 4,000 were estimated to be present in a large lotus bed. 200 wood ducks were banded before their departure in the fall of 1936. Returns were received from Texas, Tennessee, and Louisiana.

Rigid enforcement is of primary importance in restoring and maintaining this species. Refuges should be established where wood ducks are known to breed in large numbers. Nest boxes should be set up in areas attractive to them and where they were formerly known to be common, predator control should be practiced where wood ducks congregate. Literature describing these and other protected birds should be better circulated among hunters. Artificial propagation and restocking should be practiced where the birds have failed to return. Wood ducks should be forever protected. This magnificent species which nature has adorned so attractively should be preserved as a symbol of achievement in conservation.

Life Histories: Woodcock

Aldous, C. M. Woodcock-management studies in Maine, 1937, pp. 839-846, 1 table.

Report of progress in studies of migration, singing grounds, nesting cover, seasonal abundance, census methods, banding, losses due to predators and other causes, parasites, food habits (tabulation of principal items in 55 stomachs), and weights and measurements.

Management: Antelope

Einarsen, Arthur S. Life history and management of antelope in Oregon, pp. 381-387, 1 map.

About two-fifths of the State was originally inhabited by antelopes, but only half of that range is now utilized. The animals were heavily hunted and reduced by 1913 to about 2,000 head. From 1925 effective protection was extended and in 1936-37 about 17,000 antelopes were counted. The sexes are about equal in number; the birth rate seems to vary considerably and should be taken into consideration in fixing seasons and bags. Intrusion upon farm water holes and into hay and grain fields are resented. Water supplies should be developed to attract the animals to now little used parts of their former range. Discussion of factors bearing upon the hunting season, with recommendations. Regulations should be adjusted annually in accordance with existing conditions.

Management: Bobwhite

Wilson, Kenneth A. Quail management in Maryland, pp. 709-718, 2 tables.

Summary of 27 months' experience on a Farm Security Administration project. Description of tract and discussion of results as to food habit studies, food patches, plant transition studies, seed collecting, and census. The quail population increased 382 percent and the carrying capacity improved

to a bird to 7 acres in contrast with the original 1:35 ratio. Population densities are compared for different types of environment. The tables give details of the food habit study and of the census and list quail food plants of different types of soil. The author's summary is: "It was found that: (1) On the Eastern Shore of Maryland submarginal land is especially well adapted to multiple use conditioning because so much of one work dovetails into that of the other. Ditch drainage that creates better forest growing conditions likewise creates livable habitats for quail and other wildlife. Cultivated strips of land that grow food for quail also provide fire protection for the forest. Forest thinnings that release timber trees also release game food-producing trees and shrubs. (2) The provision of good drainage and substantial fall and winter food contributed more than anything else to the present increase of quail. (3) Where optimum escape cover exists, other things being equal, predator control is not necessary. (4) Land cultivation increases the food supply of hawks, owls, and other predators in the form of mice. (5) Plant transition from cultivated land to broomsedge is three years in badly acid soil and four years in clay. (6) From five to six years following broomsedge an understory of panic grasses, paspalums and partridge pea produce some fall and winter food for quail. (7) Well-drained, sandy soil supports abundant quail food-producing legumes, acid soil does not. Partridge pea is the only legume that grows abundantly in acid soil. (8) Partridge pea grows and produces seed equally well in heavy sour soil or light sandy soil; pure stands produced 330 lbs. of clean seed to the acre. (9) Ninety-two per cent of all the quail lived around cultivated land. (10) The following proportions of submarginal land are capable of supporting a winter population of one quail for each 7 acres: pine and mixed hardwoods, 72 per cent; swamp woodland, 10 per cent; broomsedge field, 8 per cent; brushland, 5 per cent, and fallow land, 5 per cent." Bibliography of 6 titles. (Abstract from WILDLIFE REVIEW, No. 15, July 1938, pp. 25-26.)

Management: Cottontail

Stuber, James W. Cottontail rabbit propagation, pp. 651-658.

The cottontail is the most popular game animal in Ohio and various other States. Propagation in confinement proving impracticable, restoration in the wild, aided by extensive stocking of propagation areas, has been tried. These breeding refuge tracts vary in size from 75 to 250 acres and are located in every county. Feed patches (soybeans, corn, sunflowers, clovers) are planted, and salt is provided in all of them the year round. Cover is improved by planting such crops as alfalfa, clovers, timothy, Sudan grass, and sunflowers, and by draping brush piles and briars with soybean and alfalfa vines. Groundhogs are advantageous in making winter dens and should be introduced where previously cut down by wanton killing. Cooperation of sportsmen in the program. Notes on diseases, life-history, restocking, and on predators and their control.

Management: Counting big game

McCutchen, A. A. Preliminary results of wildlife census based on actual counts as compared to previous estimates on National Forests, Region 2, pp. 407-414, 1 table.

Information on wildlife populations is the fundamental basis for management and it cannot be too accurate. Qualifications and training of counters. Complete coverage of the census area has proved most satisfactory; sampling is unreliable; airplane observation, insufficient in itself, is useful as a supplement. Notes on methods. Results of surveys do not agree very well with previous estimates. They are tabulated and discussed.

Management: Counting elk

Schalane, Victor H. The annual northern Yellowstone elk herd count, pp. 388-389.

Methods, experiences; result in 1937, a combined count and estimate of 9,675 animals.

Management: Deer on the Kaibab

Boone, R. P. Deer management on the Kaibab, pp. 368-375.

The Kaibab Plateau, long famous for its productivity of mule deer, was mostly converted into a national game preserve in 1906. Then all killing of deer was prohibited, mountain lions and coyotes were killed, and an influx of domestic livestock begun. The increase in domestic animals was rapid, and the deer multiplied under protection so that by 1920 the carrying capacity of the range was greatly overtaxed. Adverse public sentiment hindered remedial action, but from 1923-26 a considerable reduction in livestock was accomplished and from 1924-30 the deer population was greatly reduced by hunting. The present paper reports in some detail upon seasonal ranges and movements of the deer, the principal food plants, and the degree of overbrowsing. Plantations and experimental cuttings were tested as means of improving the forage but both seemed impracticable. Clipping studies were made to determine resistance of food plants to browsing, and safe degrees of utilization. Experimental plots are maintained to determine the inter-relationship of grazing between deer and livestock. Life history of the deer is being studied from various points of view. Counts are being made of total numbers, sexes, and age groups. Removal of surplus deer includes does as well as bucks. Hunting is now regulated. Trapping for fur cuts down the number of coyotes and bobcats, and hunting of pumas for sport under special permits is allowed. The broad objective is to maintain control of all animals and to make each species contribute its share to recreational and profit-taking uses of the area.

Management: Fence rows

Edminster, Frank C. The farm fence in wildlife management and erosion control, pp. 583-591, 1 fig., 3 tables.

In general, farm fields lack year-round shelter; opportunity for improving cover lies mainly in fence rows. Shrubby fence rows harbor birds of value in consuming insects and wood seeds, act as barriers to soil erosion, serve as windbreaks, and produce wild fruits, some of which are gathered for home use.

"Clean farming" is continued not so much for proved utility as because it is fashionable. Reversing the trend is a problem in education, namely to make it "good form" to maintain hedgerows. Studies of environment in relation to the pheasant population in Seneca County, N. Y. showed that land with shrubby fence rows had materially greater carrying capacity than "clean farmed" areas. Authors are quoted to show similar effects for quail in Texas and California, and the Hungarian partridge in Michigan. Woody vegetation will come into undisturbed fence rows by natural processes, but may well be planted to hasten realization of benefits. Factors that should be taken into consideration in selecting planting material are mentioned under 12 headings and a table suggests woody plants suitable for the Northeastern States; gives information on their moisture and soil tolerances, height, and period of availability of fruit; and mentions kinds of wildlife the plants benefit. Bibliography of 6 titles. (Abstract quoted from WILDLIFE REVIEW, No. 15, July 1938, p. 27.)

Management: Food patches

Fry, John R. Wildlife food patches: Results of four years of observations in southwestern Wisconsin, pp. 730-735, 1 table.

Discussion and tabulation of the qualifications of tested grains as to yield, maturing season, freedom from disease, use by small birds, resistance to lodging, shattering tendency, and palatability. Yellow dent corn comes closest to being the ideal species. It is very desirable that seed for food patches be obtainable locally. A patch should be at least a quarter acre in size, near good winter cover, and preferably part of a regularly cultivated field. Bibliography of 5 titles.

Management: Forest game

Douglas, L. H. The principal factors controlling big game populations in the Central Rocky Mountain Region, pp. 296-301, 1 table.

Except in a few localities, forage is not an important factor in explaining present numbers of deer and elk. "The number of deer has no relation to the number of domestic sheep, but has a very distinct relation to the presence of game refuges where there is no legal hunting." Colorado forests are not overpopulated with deer and with added winter range could support more than twice the existing population. History of the deer, elk, antelope, and bighorn populations of certain areas and suggestions as to improved handling. "Excess killing where the numbers already are too small must end. Settlement on sub-marginal lands on old migration routes and winter range should be eliminated. Overstocking of spring, fall, and winter range by cattle and sheep should be reduced."

Management: Fur animals, Canada

Bonnycastle, R. H. G. Hudson's Bay Company. Canada's fur trade, pp. 531-537.

Brief reference to history of the Company. Comparison of fur catch and industry in the United States and Canada. The Hudson's Bay Company has been

in existence 268 years and now operates 230 trading posts. Fluctuations in populations of fur animals, some a matter of record for 150 years. Protection of fur animals by curtailment of trapping seasons and by restriction of trapping privileges to Eskimos and Indians. Account of a large beaver restoration project in Quebec and of a muskrat farm in Manitoba and other fur farming projects.

Management: General

Robertson, A. Willis, A. M. Day, and W. C. Adams. How the Pittman-Robertson Act will operate to restore wildlife in the States, pp. 56-65.

Discussion, necessarily in the future tense, of the apparent advantages and disadvantages of Federal aid to the States in wildlife restoration. Concrete suggestions by Day as to what can and cannot be done include the following positive endeavors: (1) The purchase of land for wildlife purposes, (2) the development of land to make it more suitable for wild animals and birds, and (3) research projects directed toward the solution of problems that stand in the way of wildlife restoration.

Management: Harvesting on controlled shooting areas

Gerstell, Richard. Measured game and recreational production on controlled shooting areas, pp. 570-575, 4 tables.

In connection with the Pennsylvania farm-game refuge program, three trial controlled shooting areas were established. This paper is a report on some of the results obtained during a biennium on two of the areas and for a single year on the third. Methods of establishment and operation are described and costs cited. The data presented are tabulated to show number of hunters using the areas, number of hunting hours and the average per man and per head of game bagged, the number of principal game species killed and the acres and hours involved. The possibility of collecting a great variety of information useful in game administration is pointed out.

Management: Harvesting deer

Seamans, Roger. The relation of the whitetail deer to habitat in Windham County, Vt., pp. 243-247, 2 tables.

White-tailed deer nearly extirpated from the State, were replenished with introduced stock in 1878 and later protected until 1897. The population built up most rapidly and withstood hunting better in Windham County where the study reported upon was made. Topography and vegetation of the area are briefly described, and the forest types tabulated for the 10 townships. The deer kill and the number of acres to each head bagged also are tabulated but there appear to be no correlations. One deer in the total kill represented acreages varying from 263 to 2,880 (average 770).

Management: Harvesting waterfowl

Wilson, Vanoz T. Management of waterfowl public shooting grounds, pp. 633-639, 3 tables.

Description of system in use on that part of the Bear River Migratory Bird Refuge, Utah, that is used for public shooting. Tabulation of the kill from 1932 to 1937 by years and species. In 1937 there were 2,532 hunters who made a bag of 7,809 ducks and geese, an average of 3.1 birds per man. The number of waterfowl taken is estimated at 1.5 percent of the average seasonal population and at about a fourth of the number bred on the refuge.

Management: Herd regulation

Schilling, E. A. Management of whitetail deer on the Pisgah National Game Preserve (summary of five-year study), pp. 248-255.

On this 100,000 acre tract deer increased until in 1929 they threatened the forest vegetation. Counts showed a herd growth from 1,000 to 9,500 in 17 years. The deer are a mixture of various subspecies and vary greatly in color, form, and weight. The herd instinct is not dominant. The animals are as much nocturnal as diurnal. Seasonal movements are governed almost entirely by food; they are briefly outlined. Breeding, molting, and antler development are briefly discussed. The sex ratio of trapped fawns was 53:47; in all probability that normal to adults is 50:50 or 1:1. Diseases and parasites are catalogued; they have caused no epidemics in the last 20 years. Food varies with the season; rhododendron is most important in winter; grass, other herbage and new growth on shrubs and trees in spring; acorns, beechnuts, and black gum berries in fall. Palatability ratings have been computed for 270 species. Winter food is the real criterion for establishing carrying capacity. Careful study showed this should be 2,500 deer as against the 9,500 actually present. These figures represent, respectively, one deer to 11.2 and 40.7 acres. The effects of overbrowsing on several common trees is described. The Pisgah deer herd is eating itself out of house and home and must be reduced. Reduction will be carried on until the proper carrying capacity is reached.

Management: Inventory, fur catch in Vermont

Davis, Geo. W. An analysis of Vermont fur dealer reports, pp. 504-507, 2 tables.

Author's abstract: "Reports of furs handled in Vermont for a two year period were studied. Number of pelts purchased are given for seasons 1935-36 and 1936-37. Value of annual crop is estimated by average prices reported by dealers. Discussion of market conditions and recommended legislative changes are mentioned."

The figures are 1935-36, 136,271 animals, value $280,000; 1936-37, 111,141 and $320,000.

Management: Inventory, Ohio game mammals

Hicks, Lawrence E. The status of game mammals in Ohio, pp. 415-420, 5 tables.

"Seventy species of mammals have been recorded for Ohio in historic times. Of these, 8 or 12% are moles and shrews, 10 or 14% are bats, 17 or 24% are carnivores, 30 or 43% are rodents, and only 4 or 6% are hoofed animals (big game).

"Of these eleven species no longer occur in the State. The extirpated species include: Wolverine, fisher, pine marten, timber wolf, Canada lynx, bobcat, mountain lion, snowshoe rabbit, elk, moose, and bison. Except for rats (from Europe) and the reintroduction of the white-tailed deer, no wild mammal has ever been successfully introduced into Ohio. The coyote has recently invaded from the west and the beaver (once present) has recently come in from the northeast.

"Four species, once thought to have disappeared, have recently been recorded: Black bear, American otter, American badger, and Canada porcupine. The gray fox, unreported for a number of years, has increased during the last two decades until it is very common in the southeastern fourth of the State. The white-tailed deer, once probably entirely extirpated, has spread from introductions in southern Ohio and has invaded from Pennsylvania and West Virginia until the last State census listed 1,750 individuals in 28 eastern and southern counties. The State mammal list in 1938 stands at 59 species."

A 5-year average catch of 7 kinds of fur animals is tabulated. The total is nearly 19 million and its value about 2 million dollars. Details are given for two counties. The relative abundance of three kinds of squirrels throughout the State is tabulated. The status and kill of the gray squirrel, fox squirrel, and cottontail are discussed. Bibliography of 16 titles.

Management: Muskingum Watershed, Ohio

Nesbit, Ray J. Wildlife management in the Muskingum Watershed Conservancy District, pp. 592-596, 1 table.

Description of this large flood control and water conservation project that includes 11 permanent impoundments. Opportunity for wildlife management is good on 60,000 acres of publicly-owned land and water. Some wildlife was destroyed by flooding but this loss is more than made up for by general improvement in the environment. Reservoir basins are cleared and debrushed to discourage occupation by wildlife. Numerous wildlife safety zones and propagation areas have been reserved. Winter feeding, stocking, and a small amount of localized predator control also are part of the program. Two entire lakes and parts of two others have been made sanctuaries, and several of the new reservoirs have been planted to sago pondweed. Feed patches are established under a share-cropping arrangement with tenant farmers.

Management: Pests in relation to wildlife

Strong, Lee A. Insect and pest control in relation to wildlife, pp. 543-547.

Regulations designed to prevent spread of injurious forms, as barberries, bear upon planting for wildlife. Insecticides are prepared and used so as to be least harmful and experiments and observations demonstrate that the widely employed grasshopper bait, for example, when used as directed, is not detrimental to wildlife. Insects destroy food plants and their control may be important to wildlife. Again insect pests are directly injurious and insecticidal campaigns may provide relief. "The control of insects and plant diseases is merely a form of wildlife management, the object of which x x x is the greatest good to the greatest number."

Management: Planting for wildlife

Sharp, Ward M. Food and cover plant nurseries and planting out methods for wildlife in the Great Plains, pp. 538-542.

Many tree and shrub pioneers along watercourses in the Great Plains were carried there by wildlife; depletion of the woodland environment by man and domestic animals has, therefore, been immediately and seriously harmful to wildlife. In most tree planting projects the needs of wildlife received little attention. Temporary nurseries were established so that refuges could be economically supplied with acclimated stock of the species desired. Description of favorable site and the development and care of nurseries. Suggestions as to types of stock, field planting methods, and the factors that determine success (climate, grasshoppers, rabbits, gophers, livestock). Qualifications of species desirable for planting and list of recommended trees and shrubs.

Management: Refuges

Steen, M. O. Development of Federal refuges in the Great Plains region with emergency relief funds, pp. 628-632.

Projects sponsored by the Biological Survey and financed by the National Youth Administration and Works Progress Administration. Framing applications, details of financing, drafting of contracts, selection of personnel. Easement projects bring greatest returns for the funds invested. Eighty of these, totaling 130,000 acres, already established in northern plains states. Their value for water conservation, fur animal and waterfowl production, and recreation. The proportion of land now available for wildlife restoration is small and should be utilized as fully as possible. The easement refuge plan is capable of great extension and is the plan best adapted to privately-owned lands, the management of which will have a decisive influence on the future of American wildlife.

Management: Refuges

Stone, Howard L., J. C. Salyer, H. D. Ruhl, and F. P. Schwab. Is the Federal waterfowl refuge program proceeding wisely?, pp. 201-213.

Stone. Representing North Dakota, formerly the best U. S. wild fowl breeding area but transformed by drainage and drought, this speaker welcomes and approves the Federal waterfowl refuge program that is in part reversing former unfortunate land policies.

Salyer. The Federal migratory restoration program was thoroughly planned with the aid of information that had been accumulated through the whole existence of the Biological Survey--some 50 years. Information is given on the number, acreage, and classification of the refuges already acquired. They benefit water birds of all kinds, and improve the nesting and wintering grounds as well as the flyways of the migratory game birds. Drained or otherwise damaged sites were acquired as supplementing areas still in good condition; story of their development and improvement. Examples showing how the waterfowl are responding to the facilities provided for them. Notes on policing the refuges.

Ruhl. Large programs executed in a hurry cannot be free from mistakes but the Federal refuge work has proceeded more satisfactorily than could reasonably be expected. Refuges have their place but are not a flexible feature of wildlife management; regulation of seasons and bag limits are the most effective means of adjusting the annual kill to correspond with production. There should be adequate provision for public hunting grounds. The value of refuges as training places for personnel, and as outdoor research and demonstration areas. Maintenance must be provided for and the refuges should be made as nearly as may be self-supporting.

Schwab. Program approved; Iowa now has enough refuges but needs public shooting grounds. Constant management required to get the best results from a refuge system. It should be based on adequate research.

Management: Squirrels

Goodrum, Phil. Squirrel management in east Texas, pp. 670-676, 1 table.

Squirrels (southern gray and fox) are the objective of 85 percent of the hunters. They have been reduced by exploitation of their woodland environment. They have two breeding periods each year and the open season in every one of the 47 counties in their range in part covers these periods. A 2-month open season (Oct. 15-Dec. 15) and a bag limit of 5 are recommended. Good squirrel habitat cannot be made quickly, so that existing must be conserved. It can be improved, however, and suggestions are made. Light grazing may favor the squirrel population but overgrazing is detrimental. Notes on private shooting preserves, their regulations, and take are presented, the kill being analyzed with respect to acreage, hunters, and cost.

Management: Stocking Canada geese

Pirnie, Miles D. Restocking of the Canada Goose successful in southern Michigan, pp. 624-627, 1 photo.

From author's abstract: Since 1928, a captive flock of Canada geese has nested at the W. K. Kellogg Bird Sanctuary near Battle Creek. At first, the young were pinioned to add to the captive flock, but since 1931, less than two dozen of the young have been so treated, and more than 125 young have been allowed to fly as they please. Since about 1930, full-winged escaped birds have been nesting in this vicinity with an annual yield of young in excess of

those produced inside the Sanctuary. Geese have long stopped, spring and fall, in this vicinity, but nesting records were lacking until the time of these releases. There has been a great increase in local nesting away from the Sanctuary to distances of 20 to 40 miles. Gradually, since 1930, the number of wintering geese has increased from as few as 50 fliers to well over 300 in 1936-37. Some of these geese have become migratory, and seem to depart about the time of the late goose flight in November and early December.

Management: Stocking, climographic analysis

Cahn, A. R. A climographic analysis of the problem of introducing three exotic game birds into the Tennessee Valley and vicinity, pp. 807-817, 6 figs.

In general, animal species, subspecies, or races are confined to relatively limited areas having definite environmental factors to which the forms are physiologically, if not anatomically, adapted. Attempts at transplanting them to environment that is radically different, especially in the critical breeding season, therefore, are not likely to succeed. The climograph offers a means of determining in advance whether conditions in the proposed area of introduction are sufficiently similar to those of the native home to promise success. Climographic analysis indicates that neither the Hungarian partridge, ring-necked pheasant, or chukar partridge are suitable for stocking the Tennessee Valley region.

From author's summary: The Tennessee Valley has been used as an example merely because the writer happens to be working in that region. Behind the facts presented lies a much broader principle and a field of application of this method of environmental analysis far greater in scope than the Tennessee Valley. For if those organizations all over the country which are enthusiastically introducing exotics into their local regions at expenditure of effort and money, will calmly sit down, and with a sheet of graph paper plot comparisons of native environmental optima of the species they wish to introduce with local environmental conditions, they will have before them a safe guide to action that may save them thousands of dollars--and at the same time (what is more important, perhaps) save the lives of hundreds of thousands of birds, which otherwise would be sacrificed on the altar of enthusiastic ignorance.

Management: Stocking results, bobwhite and pheasant

Gerstell, Richard. An analysis of the reported returns obtained from the release of 30,000 artificially propagated ringneck pheasants and bobwhite quail, pp. 724-729, 5 tables.

The Pennsylvania Game Commission bands or otherwise marks practically all animals used in its stocking operations. This paper reports certain results from about 15 months' experience with pheasants and quail. From one lot of 2,000 pheasants a return of 19.1 percent was obtained the first season and only 0.9 percent the second. The returns from first class range averaged more than thrice those from second rate environment. This trend was paralleled by results from a second and larger release in 3 grades of range. Returns from spring stocking were less than a fifth of those resulting from fall operations.

From 39 to 54 percent of the birds were killed in townships other than those in which they were released. Individual movements up to 35-40 miles airline were not uncommon. The findings indicate that birds released in first class pheasant territory tend to evidence comparatively limited movement and to yield high returns, while those turned out on inferior ranges show wider movements and lower returns. Summarized results from more than 12,000 stocked bobwhites show a much greater discrepancy between returns of spring and fall planted birds.

Management: White-tailed deer

Adams, Harry E. Deer census and kill records of the Lake States, pp. 287-295, 3 tables.

Author's abstract: "This paper covers an analysis of deer census and hunting take data collected in 8 Lake States National Forests during the years 1934-37 inclusive. These studies indicate the practicability of deer censuses by the drive method and hunting checks under certain conditions and the reliability of the methods in determining hunting pressure and population trends. Analysis of the drive method taken on representative areas indicates that discrepancies may occur due in part to faulty organization of the drives, although from year to year fluctuations may occur in the distribution of deer occasioned by seasonal movements, poaching, fires, and logging. The browse on many of the national forests has either reached maximum abundance or is in the process of being depleted by the natural succession. Under virgin forest conditions, little browse was produced. Upon completion of lumbering activities, the food of deer increased tremendously and the deer population responded accordingly. From the analysis of population and browse inventories, it is evident that in many instances the deer herds have reached their maximum abundance. Checks indicate that the success ratio of deer hunters has remained about the same during the last four years although the hunting pressure has increased over one hundred percent. About one hunter in three is successful in taking a deer."

Management: White-tailed deer

Olson, Herman F. Deer tagging and population studies in Minnesota, pp. 280-286, 7 tables.

Author's abstract: "The paper deals with studies made on the Superior National Forest, including the results of deer censuses, hunting checks, winter mortality, and deer tagging, during the past three years. The author concluded that in general heavier hunting is desirable and possible, although studies have not reached the stage where allowable take or carrying capacity can be stated in terms of numbers of animals. The return of tagged deer during the hunting season serves as a check on the deer census method of determining populations. Information is presented on the average dressed weight of deer by sex and age classes, as well as the causes of death in winter deer yards, and the sex and age classes among which winter losses occur."

Management: Wildlife in land planning

Bode, I. T., Seth Gordon, and H. L. Shantz. How best to plan for wildlife in land management, pp. 16-25.

Shantz. About 1 acre in 11 in the United States is now in national forests. There are 349 State game refuges, 31 Federal refuges, and 120 other areas set aside in the special interests of wildlife. They total some 29 million acres. A regulation of the Secretary of Agriculture authorizes the forester to close to trespass any area vital to the preservation of threatened species. Under this proviso a sanctuary for the California condor has been provided in the Los Padros National Forest. The forests must be managed on a land-planning basis and the principle of multiple use, including management for wildlife, reasonably applied. The winter range problem is the most pressing and about 9 million acres of additional winter range, adequately managed, are needed to serve the big game animals now present on the national forests. Twenty-five million acres would be required to balance maximum summer range capacity. Over-crowding exists in a number of localities and regulated hunting of both sexes is recognized as the only feasible remedy for these concentrations. Notes on beaver transplanting, encouragement of aquatic and upland game birds, and on cooperative undertakings.

Bode. Conservation is not solely a Federal and State function but to succeed must be applied on private lands by their owners or occupants. To have wildlife management widely adopted we must show that it will fit into regularly accepted systems of land use and land practice. We must also show the individual land-owner just how desired results may be obtained--a thing that still requires a great deal of finding out--the job of wildlife research stations.

Gordon. The problems on public and on private lands are very different, but in either case should be based on thorough research, which is no sooner begun than it involves application. Discussion of the Pennsylvania farm game and small refuge program. What the landowners want above all is respect for their rights and protection for their property. "The biggest job, after you have done the cover and food improvement work, is managing the human relations problems or regulating the take so as not to overshoot your annual production."

Pollution

Wolman, Abel, David Stroop, and Richard H. Pough. How shall we approach the pollution problem?, pp. 67-74.

Investigation and cooperative and legally obligated control discussed by proponents of each plan, together with discussion by several speakers, more of the do-something-now school.

Predation: In relation to carrying capacity

Errington, Paul L., and H. L. Stoddard. Modifications in predation theory suggested by ecological studies of the bobwhite quail, pp. 736-740.

In Georgia and Florida, predators apparently did, while in Wisconsin and Iowa they did not, reduce prey populations below the carrying capacity of the environment. It appears that lower predator densities in the Southeast may exert more severe pressure upon bobwhite populations than do equivalent or even higher predator densities in the northern Mississippi Valley. A suggested ex-

planation is fluctuations in the cotton rat population in the South are accompanied by oscillations in numbers of predators, which result in abnormal predation on bobwhites when cotton rats are scarce. By contrast, buffer and prey populations seem to be more stabilized in the northern area. Bibliography of 9 titles.

Predation: On upland game birds, South Dakota

Boed, Watson E. Do fur bearers affect upland game birds in winter?, pp. 508-510.

Author's abstract: "This study was made on the Waubay Migratory Waterfowl Refuge, Day County, S. Dak., during the winter of 1936-37 and November and December, 1937. The species of fur-bearers found included the coyote, the badger, the mink, the skunk, the raccoon, the weasel, and the feral house cat. Their relative abundance and their food-habits as ascertained by field studies and stomach examinations are discussed. Climatic conditions during the study were recorded and the effects of the extreme cold and large amount of snow on upland game birds, fur-bearers, and on food and cover conditions for these animals were compiled. Four species of upland game birds, ring-necked pheasant, prairie chicken, European partridge, and sharp-tailed grouse were present during the study. The effects of the different species of fur-bearers on these birds as shown by the study are given. A discussion is made of the relationships of rodents to predation by fur-bearers on upland game birds, such as the evident buffer effects on jack rabbits, cottontails, meadow mice, white-footed mice, and domestic fowls between the coyote and upland game birds. Based on conditions during the study, the conclusion would be that the fur-bearers studied have little effect on upland game birds during winter."

Predation: On valley quail

Horn, E. E. Factors in nesting losses of the California valley quail, pp. 741-746.

Ranges and characteristics of California quail are described. Almost unbelievable early abundance of the valley quail was rapidly reduced by hunting, especially for the market. In seeking to improve conditions, vermin control was popularly adopted. No attempts to regulate the annual take were made. The factual basis for management was lacking and the investigation here reported upon was undertaken to remedy the deficiency, at least in part. There is a discussion of poisoning campaigns for the control of ground squirrels and other rodents in relation to game bird populations. With strychnine as the agent, no losses were noted; with thallium, even if a few quail are killed, the loss is more than offset by the reduction in squirrels, the principal quail-nest destroyers. Fluctuations in food supply by seasons or due to drouth are discussed and the importance of rodents as competitors for quail food pointed out. Investigation and experiment showed that ground squirrels play a serious part in causing nesting losses and that squirrel-control measures may be of value as a management measure. Other predators also are mentioned. A great increase in quail accompanied ground squirrel reduction in 1936, but in 1937 with squirrels and other predators in no greater numbers, the quail population

very materially decreased. This change is accepted as an example of the little understood phenomenon of population fluctuation. [May not the previous increase also be so interpreted?]

Predation: On white-tailed deer

Aiton, John F. Relationship of predators to whitetail deer in Glacier National Park, pp. 302-304, 2 tables.

Tabulation of evidence as to cause of death of 240 deer. 138 or 57.5 percent were found not to have been killed by coyotes. "The small percentage of losses attributable to predators in comparison to the large percentage due to other causes definitely puts the predator problem in a secondary status." One of the tables shows counted and estimated numbers of mountain lions, wolves, coyotes, and deer for 5 years. "The over-crowding of the winter range of the whitetail deer, resulting in an inferior and decreased forage supply, presents a problem of primary importance."

Predators: Fire ants

Travis, Bernard V. Fire ant problem in the Southeast with special reference to quail, pp. 705-708.

Author's abstract: "Fire ants (Solenopsis geminata) cause serious losses among quail in the southeastern States. By attacking the eggs as soon as they are pipped or the chicks when they hatch, these insects destroy from about 4 to 16% of the young birds each year. The ants also inflict considerable damage to young citrus trees by eating the bark; and are a source of great annoyance as household pests, and to workers in fields. Studies to determine methods of control of the ants have shown that about 50 percent of the colonies can be rendered inactive by the application of dry sodium cyanide. Other fumigants, namely, chloropicrin, sulfur dioxide, and carbon disulfide are more efficient than cyanide, but their high cost does not warrant their general use. Due to the ability of the ants to detect minute quantities of insecticides or toxic substances in attractive baits, attempts to control them by this method have not yielded very promising results."

Predators: Identification by their work

Darrow, Robert. Possibilities of recognizing the evidence of predation and the species involved in the remains of grouse and grouse nests found destroyed, pp. 834-838.

Conclusions from study of 830 nests, 51 chicks, and 689 adults destroyed by predators and from observations on captive wild-trapped mammals and birds of 21 species. Experiments were made with eggs of grouse and with young pheasants. Characteristics of the treatment of both types of food by a variety of predators are described. The evidences of predation permit identifications of predators that are very accurate with respect to nests and fairly so for freshly killed birds.

Propagation: Wild turkey

Handley, C. O. Recent progress in wild turkey propagation in Virginia, pp. 847-851.

Reviews briefly the history of attempts at wild turkey propagation in Virginia and elsewhere, which in most cases resulted in the production of birds unable to support themselves when liberated and consequently worthless for restocking purposes. A plan, not new it proved, but independently worked out, was to mate captive-reared wild turkey hens to native wild gobblers; to follow modern commercial poultry methods in incubating the eggs and raising the poults; to confine the poults to be released in small pens during the juvenile molt; and to allow those to be kept as breed stock the run of large enclosures. "On the one hand, the wild instinct necessary in wild turkeys reared for release can be kept alive and even intensified by keeping the birds in small enclosures; on the other hand, the domestication of breed stock to be kept in captivity may be obtained to a desired degree by wing-clipping the birds, which, incidentally, does not interfere in any way with their mating, and giving them the freedom of a sizable yard. x x x restraint against the will produces fear, and freedom from restraint produces confidence. Recognition of these two factors, and their practical employment, we feel, is the key to success in the artificial propagation of the wild turkey."

Research: Browse preferences

Deen, J. L. Methods of studying browse preferences of deer, pp. 256-260.

Discussion of methods tried: Stalking (unsuccessful), observation from elevated platforms (unsatisfactory as to detail, but yielded valuable general information), stomach analysis (used as a check on other work rather than as a primary source of data), measurement of browsing on sample plots (gave the most exact information obtained during the study). Description of methods used in measuring and tallying evidences of browsing. Central Pennsylvania.

Research: Food habits

Cottam, Clarence, and A. L. Nelson. Why study the food of fur animals?, pp. 527-530.

Food habits studies are fundamentally important to accurate determination of the inter-relationships of the varied forms of wildlife and to learning their full significance to man. Relation of investigations of the subsistence of fur animals to the "vermin" question and to other control problems, and to management especially in maintaining necessary food supplies.

Research: Fluctuations

Skiff, J. Victor. The reported take of game as an index to population fluctuations, pp. 576-582, 3 figs.

Author's abstract: "An analysis of the value of mandatory annual reports from St te sportsmen's licenses covering the take of game, as an index to population fluctuations, based upon a compilation of such State-wide reports for a 17-year period in New York. Those reports covering 16 species of game have been reduced to a take-per-license basis, corrected for variables and plotted as line graphs which clearly show yearly and what may be cyclic fluctuations. The mechanical difficulties of the system, the limitations thereof, and the cost are discussed as part of the analysis. Refinements of the New York method are suggested as a means of evolving a more perfect one for States wishing to inaugurate this method of determining population fluctuations, as an aid in administration and management.

Research: Identifying tooth marks

Pearce, John. Identifying tooth marks of some northeastern animals on forest vegetation, pp. 690-694, 1 table.

Author's abstract: This discussion deals only with the forest mammals of the northeast. It is a practical contribution to aid those not having made a detailed study of animal work who may be required at any time to identify wildlife feeding in the woods. Since under normal conditions the most significant forest growth is that of woody plants, feeding on these is used as the basis of comparison. It will be noted that reference to animal 'damage' or 'injury' is avoided; this is to combat the widespread idea that all such feeding is necessarily damaging to the forest as a whole. Much of the confusion observed in field classification of wildlife feeding is actually quite needless. No involved technical skill--not even a hand lens--is needed to identify the great majority of all mammal feeding on woody plants. Only three simple essentials are required. Those are careful observation, some knowledge of the species likely to be found in the locality, and finally a clear idea of the relative tooth sizes and feeding procedures of these animals.

"Tooth marks are nearly all left by two readily separated groups, the rodents (including Lagomorphs) which cut or gnaw their food and the browsing forms which break it off. This fundamental difference is due to the lack of incisor teeth among deer, moose, and elk, and presence of effective upper and lower incisors among the rodents. Among the latter group separations can usually be made to species at a glance but the actual feeding of browsing game and domesticated cattle in the east is usually insoparable, on the basis of twigs alone. However, other factors can be brought into play in most cases; these are discussed to some extent. In general, rodents leave smoothly cut, slanting or conical stubs, while the deer group leaves roughly broken, shredded ends approximately square across. Marks left by bears also are discussed. Rodent's tooth marks are separated by the width of the channels left gouged or impressed in wood and bark. The measurements need seldom be taken. A table is presented, however, showing the range of width of incisors and of the marks made by them for 5 common mammals. Actually, mice, squirrels, rabbits, porcupine, and beaver all have their own band of average sizes which do not overlap enough for confusion. Once these are understood, the individual identification may be approached with confidence in the northeast."

Research: Need of on mammals

Hamilton, W. J., Jr. Research needs in mammalogy, pp. 695-698.

It is axiomatic that pure research of today is of practical value tomorrow. Life-history and population studies of mammals are needed as a basis for management and may throw light on general biological phenomena. Numerous suggestions are made as to wanted research.

Research: Need and value of

Leopold, Aldo, Walter P. Taylor, Rudolf Bennitt, and H. H. Chapman. Wildlife research--is it a practical and necessary basis for management?, pp. 42-55.

Leopold. "For the moment we are, for the most part, ecologists rather than managers"--that is, research immediately disclosed our ignorance of fundamentals and detoured earnest students away from management. Apparent management of cyclic species looks well during the upswing but we know little about cycles and nothing as to their control. Simple food and cover improvement and regulation of the kill have invariably increased pheasant populations to high levels. Research has done away with many faulty beliefs as to game species, a process that still is in need of extension to the average sportsman. Carrying capacity studies have brought back to attention a truth that every pioneer sees but refuses to believe, namely, the simultaneous abundance of both predators and prey.

[Comment. Leopold's presentation seems somewhat deprecatory. "What is the cycle x x x We don't know." Cycles have been going on indefinitely; previous regimes have not solved them and there is no exclusive responsibility upon present wildlife researchers to do so. Perhaps they are among the immutable phenomena of Nature that simply must be accepted. "Research has made few discoveries of workable technique." Again wildlife research could hardly be expected at once to transform wildlife management. What we think of as new things come about as a rule, not by abrupt creation but by modification of previous concepts or entities. Management of sorts there has been for ages, and it must go on although empirically, while research is being done to improve it. And it has been improved (or at least its possibilities have been) by every piece of pertinent research. Where the pontifical behavior noted by Leopold prevails is unknown to the abstracter but it can hardly exceed the bland presumptions of the preceding school. It seems to the commenter that there is a healthy realization of ignorance and a general willingness to cooperate in the improvement of knowledge.]

Taylor. Gives several examples of the findings of wildlife research and of their application. One concerns jack rabbits, rodents, and grasshoppers, which up to a certain point, increase directly as overgrazing increases. Conservative grazing is indicated as a control measure. Jack rabbit numbers have a more or less definite relationship to those of prairie chickens in coastal Texas. They can be readily ascertained and furnish a definite means of estimating the value of land for the prairie chickens. Other instances pertain to findings as to the food habits of armadillos in relation to quail, methods of

counting squirrels, prairie chickens, and bobwhites, stages in woodland succession most favorable to quail, and usefulness of blue jays in making acorns available to those birds.

Bennitt. Wildlife research is not only necessary but must be done by highly-trained investigators, for fundamental causes do not appear on the surface for everyone to see. Painstaking work requires time, so patience must be exercised. Results cannot be guaranteed and they may upset previous notions. There is opportunity, however, for popular cooperation in research, and seeking help of the public is a good way to combat prejudices against research.

Chapman. Man should unemotionally seek to understand what is best in the long run for himself and for the environment, including wildlife, and govern his actions accordingly. The questions to which he must have answers to do this well can be solved only by research such as has been done for agriculture, horticulture, and all forms of industry. Intelligent action must supplant emotion, prejudice, and rules of thumb in wildlife management.

Research: Primeness of fur

Ashbrook, Frank G. Preventing wastes of fur trapping when pelts are not prime, pp. 511-514.

Discussion of how primeness may be recognized, especially in muskrat pelts. Summary of a microscopical study of the subject by Professor Charles K. Gunn of the University of Manitoba.

Research: Reproductive cycle of fur animals

Enders, Robert K. Fur animal reproductive cycles and their relation to management, pp. 515-517.

The reproductive cycle or rut, oestrus, and breeding activity, includes not only the breeding season, but the whole complex series of changes involved in preparation for, and following breeding. Accurate information in this field is lacking for most wild mammals, yet is necessary to their proper management. Sketch of what is known and suggestions for research.

Weights and measurements: Northern white-tailed deer

Park, Barry C. Deer weights and measurements on the Allegheny National Forest, pp. 261-279, 1 photo, 7 graphs, 4 tables.

Description of the forest, which is in a well-populated district, and is mostly cut-over and burned-over land. Most of the second growth is less than 40 years old. The deer herd is estimated at 43,000 animals--1 to 17 acres. Proper stocking would be one animal to 40-50 acres. Overbrowsing is evident and it has materially affected reforestation. Deer damage on plantations runs as high as 94 percent. The buck law has been in effect on the area for some 30 years. The sex ratio, including fawns, was 1:5-6, excluding fawns, 1:11. Sportsmen believed the deer were becoming smaller every year. The report is

upon 3 of 5 proposed years of study. The technique of the field work is described; tables give the allowance for viscera in making estimates from dressed carcasses (averaging 20 percent), proportion of the samples to the entire kill, and percentage of successful hunters (averaging 11.8). Weight increases with age up to 9-1/2 years. A close relationship exists between weight and acres per deer. Fawns on overstocked areas are not permanently stunted during the first winter but suffer heavier losses than elsewhere. Average weights are given for sex and age classes; this factor alone is not considered a true indicator of the physical condition of the herd. There is some correlation between antler measurements and weight. Body measurements appear to be more reliable indicators of age than are antler measurements. The average number of tines on antlers is a poor index of age. Reduction of the herd is necessary to stabilize it at a level consistent with the winter food supply. Bibliography of 8 titles.

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